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L3: Entry 6 of 6

File: USPT

Mar 23, 1999

US-PAT-NO: 5885834DOCUMENT-IDENTIFIER: US 5885834 A

TITLE: Antisense oligodeoxynucleotide against phosphodiesterase

DATE-ISSUED: March 23, 1999

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|------------------|----------|-------|----------|---------|
| Epstein; Paul M. | Weatogue | CT | 06089 | |

US-CL-CURRENT: 435/375; 435/372, 435/6, 435/91.31, 536/23.1, 536/24.31, 536/24.5

CLAIMS:

I claim:

1. A method of inducing programmed cell death in a cancer cell comprising:

1) identifying the phosphodiesterase PDE1B1 in a cell line comprising said cancer cell;

2) synthesizing an antisense oligodeoxynucleotide (AS ODN) inhibitor which binds to mRNA encoding PDE1B1; and

3) applying the AS ODN to the cell line to inhibit enzymatic activity of said PDE1B1 and induce apoptosis within said cell.

2. The method of claim 1 wherein the AS ODN is a phosphorothioate AS ODN.

3. The method of claim 1 wherein the phosphodiesterase is identified by reverse transcription-polymerase chain reaction.

4. The method of claim 1 wherein the AS ODN has the sequence of a portion of a cDNA of said PDE1B1.

5. The method of claim 1 wherein the cell is a leukemic cell.

6. A purified and isolated polynucleotide encoding a 63 kDa calmodulin-dependent phosphodiesterase PDE1B1 of a human leukemic lymphoblastoid cell line.

7. A cDNA according to claim 6.

8. An antisense oligodeoxynucleotide (AS ODN) which binds to an mRNA encoding

phosphodiesterase PDE1B1.

9. The method of claim 2 wherein the PS ODN has a sequence 5'-GGACAGCTCCATGCTCAG-3' SEQ. ID NO: 5.

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☐ 1. Document ID: US 6734003 B2

L2: Entry 1 of 15

File: USPT

May 11, 2004

US-PAT-NO: 6734003

DOCUMENT-IDENTIFIER: US 6734003 B2

TITLE: Phosphodiesterase 10

DATE-ISSUED: May 11, 2004

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|----------------|---------|-------|----------|---------|
| Loughney; Kate | Seattle | WA | | |

US-CL-CURRENT: [435/196](#); [435/183](#), [530/350](#), [536/23.1](#), [536/23.2](#)

| Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KMC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|--|--|--------|-----|--------|
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☐ 2. Document ID: US 6642040 B2

L2: Entry 2 of 15

File: USPT

Nov 4, 2003

US-PAT-NO: 6642040

DOCUMENT-IDENTIFIER: US 6642040 B2

TITLE: Human cGMP-stimulated cyclic nucleotide phosphodiesterase

DATE-ISSUED: November 4, 2003

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|------------------------|--------------|-------|----------|---------|
| Beavo; Joseph A. | Seattle | WA | | |
| Bentley; Kelley J. | Seattle | WA | | |
| Charbonneau; Harry | W. Lafayette | IN | | |
| Sonnenburg; William K. | Seattle | WA | | |

US-CL-CURRENT: [435/196](#); [536/23.2](#)

| Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KMC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|--|--|--------|-----|--------|
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☐ 3. Document ID: US 6350603 B1

L2: Entry 3 of 15

File: USPT

Feb 26, 2002

US-PAT-NO: 6350603

DOCUMENT-IDENTIFIER: US 6350603 B1

**** See image for Certificate of Correction ****

TITLE: Phosphodiesterase 10

DATE-ISSUED: February 26, 2002

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|----------------|---------|-------|----------|---------|
| Loughney; Kate | Seattle | WA | | |

US-CL-CURRENT: 435/196; 435/252.3, 435/320.1, 435/325, 435/69.1, 530/350, 536/23.1, 536/23.2

| Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | FIGS | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|--|--|--------|------|--------|
|------|-------|----------|-------|--------|----------------|------|-----------|--|--|--------|------|--------|

☐ 4. Document ID: US 6221677 B1

L2: Entry 4 of 15

File: USPT

Apr 24, 2001

US-PAT-NO: 6221677

DOCUMENT-IDENTIFIER: US 6221677 B1

**** See image for Certificate of Correction ****

TITLE: Simultaneous particle separation and chemical reaction

DATE-ISSUED: April 24, 2001

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|--------------------|---------|-------|----------|---------|
| Wu; Caicai | Seattle | WA | | |
| Weigl; Bernhard | Seattle | WA | | |
| Kenny; Margaret A. | Edmonds | WA | | |
| Yager; Paul | Seattle | WA | | |

US-CL-CURRENT: 436/518; 210/198.2, 210/243, 210/511, 210/634, 210/739, 210/745, 210/748, 210/805, 210/85, 210/94, 210/96.1, 422/81, 422/82, 422/82.05, 436/172, 436/177, 436/178, 436/180, 436/52, 436/53

| Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | FIGS | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|--|--|--------|------|--------|
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☐ 5. Document ID: US 6037119 A

L2: Entry 5 of 15

File: USPT

Mar 14, 2000

US-PAT-NO: 6037119

DOCUMENT-IDENTIFIER: US 6037119 A

**** See image for Certificate of Correction ****

TITLE: Cyclic GMP-binding, cyclic GMP-specific phosphodiesterase materials and methods

DATE-ISSUED: March 14, 2000

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|----------------------------|-------------------|-------|----------|---------|
| Beavo; Joseph A. | Seattle | WA | | |
| Corbin; Jackie D. | Nashville | TN | | |
| Ferguson; Kenneth M. | Bothell | WA | | |
| Francis; Sharron H. | Nashville | TN | | |
| Kadlecek; Ann | Seattle | WA | | |
| Loughney; Kate | Seattle | WA | | |
| McAllister-Lucas; Linda M. | Nashville | TN | | |
| Sonnenburg; William K. | Mountlake Terrace | WA | | |
| Thomas; Melissa K. | Boston | MA | | |

US-CL-CURRENT: 435/6; 435/19, 435/196, 435/252.3, 435/254.2, 435/254.21, 435/320.1, 435/325, 536/23.2

| Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|--|--|--------|------|--------|
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☐ 6. Document ID: US 6015677 A

L2: Entry 6 of 15

File: USPT

Jan 18, 2000

US-PAT-NO: 6015677

DOCUMENT-IDENTIFIER: US 6015677 A

**** See image for Certificate of Correction ****

TITLE: Assay methods using DNA encoding mammalian phosphodiesterases

DATE-ISSUED: January 18, 2000

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|------------------------|-------------------|-------|----------|---------|
| Beavo; Joseph A. | Seattle | WA | | |
| Bentley; Kelley J. | Seattle | WA | | |
| Charbonneau; Harry | W. Lafayette | IN | | |
| Sonnenburg; William K. | Mountlake Terrace | WA | | |

US-CL-CURRENT: 435/6; 435/196, 435/252.3, 435/254.21, 435/29

| Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|--|--|--------|------|--------|
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☐ 7. Document ID: US 5885834 A

L2: Entry 7 of 15

File: USPT

Mar 23, 1999

US-PAT-NO: 5885834

DOCUMENT-IDENTIFIER: US 5885834 A

TITLE: Antisense oligodeoxynucleotide against phosphodiesterase

DATE-ISSUED: March 23, 1999

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|------------------|----------|-------|----------|---------|
| Epstein; Paul M. | Weatogue | CT | 06089 | |

US-CL-CURRENT: 435/375; 435/372, 435/6, 435/91.31, 536/23.1, 536/24.31, 536/24.5

| Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | RMK | Draw De |
|------|-------|----------|-------|--------|----------------|------|-----------|--|--|--------|-----|---------|
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☐ 8. Document ID: US 5858694 A

L2: Entry 8 of 15

File: USPT

Jan 12, 1999

US-PAT-NO: 5858694

DOCUMENT-IDENTIFIER: US 5858694 A

TITLE: Method for identifying compounds for inhibition of cancerous lesions

DATE-ISSUED: January 12, 1999

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|---------------------|--------------|-------|----------|---------|
| Piazza; Gary A. | Doylestown | PA | | |
| Pamukcu; Rifat | Spring House | PA | | |
| Thompson; W. Joseph | Mobile | AL | | |

US-CL-CURRENT: 435/19; 435/184

| Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | RMK | Draw De |
|------|-------|----------|-------|--------|----------------|------|-----------|--|--|--------|-----|---------|
|------|-------|----------|-------|--------|----------------|------|-----------|--|--|--------|-----|---------|

☐ 9. Document ID: US 5807691 A

L2: Entry 9 of 15

File: USPT

Sep 15, 1998

US-PAT-NO: 5807691

DOCUMENT-IDENTIFIER: US 5807691 A

TITLE: Polypeptides having serotonin receptor activity (5HT5A), nucleic acids coding for these polypeptides and uses thereof

DATE-ISSUED: September 15, 1998

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|-------------------|------------|-------|----------|---------|
| Amlaiky; Nourdine | Strasbourg | | | FR |
| Boschert; Ursula | Strasbourg | | | FR |
| Hen; Rene | Strasbourg | | | FR |
| Plassat; Jean-Luc | Strasbourg | | | FR |

US-CL-CURRENT: 435/7.21; 435/320.1, 435/325, 435/6, 435/69.1, 530/350, 536/23.5,
536/24.3, 536/24.31, 536/24.33

| Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KMC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|--|--|--------|-----|--------|
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☐ 10. Document ID: US 5800987 A

L2: Entry 10 of 15

File: USPT

Sep 1, 1998

US-PAT-NO: 5800987

DOCUMENT-IDENTIFIER: US 5800987 A

**** See image for Certificate of Correction ****

TITLE: Assay methods using DNA encoding mammalian phosphodiesterases

DATE-ISSUED: September 1, 1998

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|------------------------|-------------------|-------|----------|---------|
| Beavo; Joseph A. | Seattle | WA | | |
| Bentley; J. Kelley | Seattle | WA | | |
| Charbonneau; Harry | W. Lafayette | IN | | |
| Sonnenburg; William K. | Mountlake Terrace | WA | | |

US-CL-CURRENT: 435/6; 435/196, 435/252.3, 435/254.21, 435/29

| Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KMC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|--|--|--------|-----|--------|
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☐ 11. Document ID: US 5789553 A

L2: Entry 11 of 15

File: USPT

Aug 4, 1998

US-PAT-NO: 5789553

DOCUMENT-IDENTIFIER: US 5789553 A

TITLE: Antibodies specifically immunoreactive with human brain
Ca.sup.2+ /calmodulin cyclic nucleotide phosphodiesterase

DATE-ISSUED: August 4, 1998

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|------------------------|-------------------|-------|----------|---------|
| Beavo; Joseph A. | Seattle | WA | | |
| Bentley; J. Kelley | Seattle | WA | | |
| Charbonneau; Harry | W. Lafayette | IN | | |
| Sonnenburg; William K. | Mountlake Terrace | WA | | |

US-CL-CURRENT: 530/388.26; 530/387.9

| Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KMAC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|--|--|--------|------|--------|
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☐ 12. Document ID: US 5776752 A

L2: Entry 12 of 15

File: USPT

Jul 7, 1998

US-PAT-NO: 5776752

DOCUMENT-IDENTIFIER: US 5776752 A

TITLE: Isolated and purified calcium/calmodulin stimulated cyclic nucleotide
phosphodiesterases

DATE-ISSUED: July 7, 1998

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|------------------------|-------------------|-------|----------|---------|
| Beavo; Joseph A. | Seattle | WA | | |
| Bentley; J. Kelley | Seattle | WA | | |
| Charbonneau; Harry | W. Lafayette | IN | | |
| Sonnenburg; William K. | Mountlake Terrace | WA | | |

US-CL-CURRENT: 435/196; 530/350

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|--------|------|--------|
|------|-------|----------|-------|--------|----------------|------|-----------|--------|------|--------|

☐ 13. Document ID: US 5602019 A

L2: Entry 13 of 15

File: USPT

Feb 11, 1997

US-PAT-NO: 5602019

DOCUMENT-IDENTIFIER: US 5602019 A

**** See image for Certificate of Correction ****

TITLE: DNA encoding mammalian phosphodiesterases

DATE-ISSUED: February 11, 1997

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|------------------------|--------------|-------|----------|---------|
| Beavo; Joseph A. | Seattle | WA | | |
| Bentley; Kelley J. | Seattle | WA | | |
| Charbonneau; Harry | W. Lafayette | IN | | |
| Sonnenburg; William K. | Seattle | WA | | |

US-CL-CURRENT: 435/196; 435/199, 435/252.3, 435/254.2, 435/320.1, 435/325, 536/23.2

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|--------|------|--------|
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☐ 14. Document ID: US 5580771 A

L2: Entry 14 of 15

File: USPT

Dec 3, 1996

US-PAT-NO: 5580771

DOCUMENT-IDENTIFIER: US 5580771 A

**** See image for Certificate of Correction ****

TITLE: DNA encoding mammalian phosphodiesterases

DATE-ISSUED: December 3, 1996

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|------------------------|-------------------|-------|----------|---------|
| Beavo; Joseph A. | Seattle | WA | | |
| Charbonneau; Harry | W. Lafayette | IN | | |
| Sonnenburg; William K. | Mountlake Terrace | WA | | |

US-CL-CURRENT: 435/199; 435/196, 435/254.2, 435/320.1, 435/325, 435/365, 536/23.2

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|--------|------|--------|
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15. Document ID: US 5389527 A

L2: Entry 15 of 15

File: USPT

Feb 14, 1995

US-PAT-NO: 5389527DOCUMENT-IDENTIFIER: US 5389527 A**** See image for Certificate of Correction ****

TITLE: DNA encoding mammalian phosphodiesterases

DATE-ISSUED: February 14, 1995

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|------------------------|-------------------|-------|----------|---------|
| Beavo; Joseph A. | Seattle | WA | | |
| Charbonneau; Harry | W. Lafayette | WA | | |
| Sonnenburg; William K. | Mountlake Terrace | WA | | |

US-CL-CURRENT: 435/69.1; 435/196, 435/199, 435/252.3, 435/254.11, 435/320.1,
536/23.2

| | | | | | | | | | | | | | |
|------|-------|----------|-------|--------|----------------|------|-----------|--|--|--|--------|-----|---------|
| Full | Title | Citation | Front | Review | Classification | Date | Reference | | | | Claims | KMC | Draw De |
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File: USPT

Feb 14, 1995

US-PAT-NO: 5389527

DOCUMENT-IDENTIFIER: US 5389527 A

**** See image for Certificate of Correction ****

TITLE: DNA encoding mammalian phosphodiesterases

DATE-ISSUED: February 14, 1995

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|------------------------|-------------------|-------|----------|---------|
| Beavo; Joseph A. | Seattle | WA | | |
| Charbonneau; Harry | W. Lafayette | WA | | |
| Sonnenburg; William K. | Mountlake Terrace | WA | | |

US-CL-CURRENT: 435/69.1; 435/196, 435/199, 435/252.3, 435/254.11, 435/320.1,
536/23.2

CLAIMS:

What is claimed is:

1. A purified and isolated polynucleotide sequence comprising a polynucleotide sequence encoding a mammalian cyclic GMP stimulated nucleotide phosphodiesterase enzyme having an amino acid sequence selected from the group consisting of: SEQ ID NO: 39 and SEQ ID NO: 45.
2. A polynucleotide sequence according to claim 1 which encodes a human phosphodiesterase enzyme.
3. A polynucleotide sequence according to claim 1 which encodes a bovine phosphodiesterase enzyme.
4. A DNA sequence according to claim 3 selected from the group consisting of the bovine DNA inserts present in vectors p12.3A (A.T.C.C. 68577), pCaM-40 (A.T.C.C. 68576), pBBCGS PDE-5 (A.T.C.C. 68578), and p3CGS-5 (A.T.C.C. 68579).
5. A cDNA sequence according to claim 1.
6. A genomic DNA sequence according to claim 1.
7. A DNA vector having inserted therein a DNA sequence according to claim 1.
8. A procaryotic or eucaryotic host cell stably transformed with a polynucleotide sequence according to claim 1.

9. A yeast host cell according to claim 8.

10. A purified and isolated polynucleotide sequence comprising a polynucleotide sequence encoding a polypeptide having the enzymatic activity of a mammalian cyclic GMP stimulated nucleotide phosphodiesterase and selected from the group consisting of:

(a) the mammalian DNA inserts in vectors p3CGS-5 (A.T.C.C. 68579) and pHcgs6n (A.T.C.C. 68962);

(b) polynucleotide sequences which hybridize under stringent hybridization conditions to an antisense stand of the mammalian DNA inserts in vectors p3CGS-5 (A.T.C.C. 68579), pHcgs6n (A.T.C.C. 68962), pGSPDE6.1 (A.T.C.C. 68583), pGSPDE7.1 (A.T.C.C. 68585), pGSPDE9.2 (A.T.C.C. 68584), pBBCGSPDE-5 (A.T.C.C. 68578); and

(c) DNA sequences encoding the same polypeptide as the DNA sequences of (a) and (b) above by means of degenerate codons.

11. A method for producing a polypeptide having the enzymatic activity of a cyclic GMP stimulated cyclic nucleotide phosphodiesterase, said method comprising:

(a) stably transforming or transfecting a procaryotic or eucaryotic host cell with a polynucleotide sequence according to claim 1 or 10; and

(b) growing the host cell formed in step (a) in a nutrient medium under conditions allowing expression of said DNA sequence in said host cell.

12. A method according to claim 11 further including the step of isolating the polypeptide product of expression of said polynucleotide sequence in said host cell.

13. A method according to claim 11 wherein said host cell is a yeast host cell.

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